Characteristics and Composition of Guava (*Psidium guajava* L.) Seed and Oil

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The proximate composition of guava seed and the physicochemical characteristics of the solvent-extracted oil are reported. The fatty acid profile of the oil indicates the presence of linoleic acid ($C_{18:2}$) to the extent of 76.4% and resembles that of safflower oil in composition. The oil is easily refined and bleached on laboratory scale.

KEY WORDS: Batch extractor, EFA (essential fatty acid), FAME (fatty acid methyl esters), guava seed, linoleic acid, single-pair roller reduction mill.

Guava (*Psidium guajava* L.) (family Myrtaceae) is a well-known shrub and popular for its delicious fruit. It is grown year round all over India. India ranks third in production of guava fruit behind Brazil and the United States (1). Guava fruit is one of the richest sources of vitamin C and contains four to ten times more of this vitamin than citrus fruits (2,3). Currently, large quantities of guava fruit seeds are discarded by processing plants, aggravating a serious disposal problem, although the seeds are a potentially valuable source of fatty oil. Economical and efficient utilization of guava seeds requires more scientific data and information on the characteristics and composition of seed and oil than is available (4–6). That paucity of data stimulated this investigation.

MATERIALS AND METHODS

Psidium guajava L. seeds were supplied by Priya Foods (Hyderabad, India). All chemicals and solvents were of analytical reagent and guaranteed reagent grades and were purchased from reputed firms in India. Seeds were round and pale yellowish brown in color, and they resembled white mustard seed. Seed constitutes 6–12% by weight of the whole fruit (2,7) and depends upon the size and variety of the fruit.

Powdered seed samples were prepared by grinding in a C&N Junior Laboratory Mill, size 5″ (Christy & Norris Limited, Engineers, Chelmsford, England). Protein content (N × 6.25) was estimated by the Kjeldahl method (8). Oil, fiber, ash and insoluble ash were determined by American Oil Chemists' Society (AOCS) methods (9). For recovery of oil, seeds were moistened, flaked in a single-pair roller reduction mill and thoroughly extracted with food-grade *n*-hexane in a batch extractor at ambient temperature. The miscella was desolventized, and the residual traces of solvent were removed in vacuum at 40°C. The extracted seed meal was thoroughly air-dried to remove traces of solvent. The defatted seed meal characteristics are given in Table 1. The physicochemical characteristics of oil are presented in Table 2. The solvent-extracted seed oil was refined and bleached by adopting the AOCS cup refining apparatus and method (9), under conditions applicable to soybean oil. Alkali lye of 12°Be, 66.6% excess was used for refining. Bleaching earth (Tonsil Optimum) (2%) and activated carbon (0.2%) were used for bleaching of neutralized oil.

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Fatty acid methyl ester (FAME) analysis. FAME were prepared by acid-catalyzed transmethylation (BF_3-methanol method) (10) of the lipids. The FAME were analyzed on a Perkin-Elmer 8700 gas chromatograph (Norwalk, CT), equipped with a flame-ionization detector and a glass column (200 cm × 6.35 mm o.d.) packed with 20% diethylene glycol succinate on 80:100 mesh chromosorb W DMCS-treated support (Fig. 1). The column temperature was 170°C (isothermal), injection and detector temperatures were 225°C, and high-purity nitrogen at 20 psig was used as carrier gas. The peak areas and retention times were measured by a built-in gas chromatographic integrator. Each peak was identified on the basis of a calibration curve of retention time (log) against respective carbon chainlength and by comparison with authentic methyl ester standards. Response factors of all components were taken as 1.0, and the relative composition percentage was calculated on the basis of peak areas. All determinations were performed in triplicate, and mean values are reported in Table 3.

RESULTS AND DISCUSSION

The oil content in the seed was 16.0%, which is three times more than that reported by Verma *et al.* (5) and slightly more than the values reported by other workers (2,4,11). Fatty acid composition of guava seed oil resembles that

TABLE 1

Characteristics of *Psidium guajava* L. Seed and Meal[a,b]

	Seed	Meal
Seed index (wt of 100 seeds) (g)	0.85	—
Moisture (%)	4.1	1.5
Oil (%) (hexane extracted)	16.0	0.4
Total protein (%)	7.6	9.0
Crude fiber (%)	61.4	73.0
Total ash (%)	0.93	1.1
Acid-insoluble ash (%)	0.06	0.07
Oil (%) (in kernel)	70.0	—

[a]Data are the means of the determinations.
[b]Except for moisture, all analyses are on a dry-weight basis.

TABLE 2

Physicochemical Characteristics[a] of *Psidium guajava* L. Seed Oil

Acid value	1.7
Refractive index at 40°C	1.4772
Specific gravity, 30°C:30°C	0.9207
Iodine value (Wijs)	134.0
Saponification value	196.0
Nonsaponifiable matter (%)	0.49
Total glycerol (%)	10.5
Color (2.54-cm cell, in Lovibond scale)	10.4Y + 0.6R
Viscosity[b] (37°C) (in Redwood seconds)	152

[a]Values represent the average of duplicate analyses of two replicates.
[b]See Reference 13.

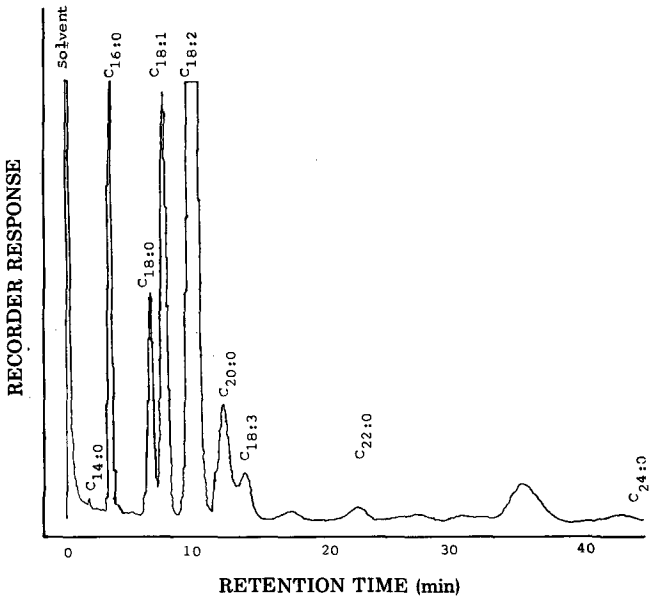

FIG. 1. Fatty acid methyl ester analysis of guava (*Psidium guajava* L.) seed oil.

TABLE 3

Fatty Acid Composition of *Psidium guajava* L. Seed Oil[a]

Fatty acid	Percentage by weight
Myristic	0.1
Palmitic	6.6
Stearic	4.6
Oleic	10.8
Linoleic	76.4
Arachidic	0.3
Linolenic	0.1
Behenic	0.1
Lignoceric	0.1
Others	0.9
Total saturates	11.8
Total unsaturates	87.3
Polyunsaturates (EFA)	76.5

[a]Each value is an average of three determinations. EFA, essential fatty acids.

of safflower oil (12). Our results are distinctly different from previous reports (4–7). These differences in oil content and fatty acid composition may be due to more modern technologies, to new high-yielding cultivars after grafting and to habitats and environmental factors. The high iodine value of 134.0 of the oil and the high refractive index of 1.4772 at 40°C reflect high unsaturated fatty acid content of the oil. Linoleic acid is 76.4%, which indicates that it is a semi-drying oil. A saponification value of 196 and total glycerol content of 10.5 and low non-saponifiable matter of *ca.* 0.5% indicate that the oil is a normal triglyceride. Guava seed oil could be easily refined to low free fatty acid (refining loss 4.0%) and bleached to a light-colored (3Y + 0.1R on Lovibond scale) and bland oil of edible quality.

The present study shows that *P. guajava* seed oil is a good source of linoleic acid, an essential fatty acid. This oil may be used to nutritional advantage by blending it with highly saturated edible oils to provide new oils with modified nutritional values. The oil can also be used in the formulation of paints, surface coatings and oleochemicals.

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